

Introduction

- Exercise is not only associated with greater physical and mental health^[1], but is a meaningful occupation for wheelchair users.
- Wheelchair users engage in less physical activity than able bodied persons due to various physical, personal and environmental barriers^[2]; for example, the lack of accessible cardiovascular exercise equipment specifically designed for this population.
- Currently, some wheelchair users exercise with an arm cycle ergometer, which is well accepted, effective and easy to use, but is not commonly available. Given the prevalence of rowing machines, researchers at ICORD have developed adaptations that allow commercially available rowing machines to be used by wheelchair users in community gyms.



Objective

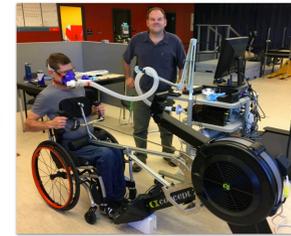
- To explore the usability of the newly developed adaptive rowing machine (ARM) compared to the already existing arm cycle through users' perspectives.

Participants

- 14 participants were recruited from ICORD's Physical Activity Research Centre. All participants have a spinal cord injury/disease and exercise at least once a week.

Variable	Mean (+/-SD) or n(%)
Age (years)	42.7 (±13.5) years
Female	3 (21%)
Diagnosis:	
Paraplegia	10 (72%)
Tetraplegia	3 (21%)
MS	1 (7%)

Methods



- First, participants completed the physiology and energetic portion of the study, i.e., they exercised for 5 minutes at roughly the same power-output on both the ARM and the standard Monark arm-cycle (random order).
- Within 48hrs of the exercise trial, participants completed both a 12 question semi-structured interview and the System Usability Scale (SUS) via telephone.
- Conventional content analysis was applied to the data, in which coding categories were derived directly from the text^[3].
- SUS data were analyzed using a paired sample t-test and comparison of individual scores.

Results

- As shown in Figure 1 and Table 2, there was no significant difference between SUS individual and groups scores for the ARM and the arm cycle. Both mean scores are within the 90-100th percentile, in terms of usability of a product^[4].
- Tables 3 and 4 show the most common perspectives of users'.
- Most common barriers to cardio exercise identified by participants: lack of accessible equipment, physical function, and inaccessible facilities.
- Consistent with findings from the energetic component of the study, 13 participants stated the ARM was better for cardiovascular exercise compared to the arm cycle.
- 12 participants reported they would use the ARM in the community.
- 13 participants foresaw a positive impact from increased accessible cardio equipment, including increased opportunity for effective cardio exercise, greater socialization, and increased exercise frequency.

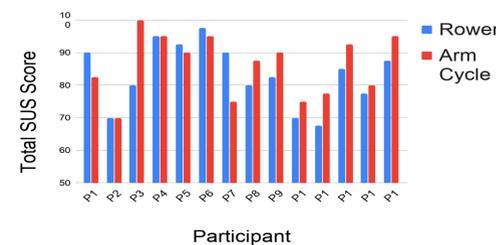


Figure 1. Participants' total SUS scores for the arm cycle and adaptive rower.

	Mean (SD)	p-value
Adaptive Rowing Machine	83.21 (9.58)	0.23
Arm Cycle	86.07 (9.34)	

	n (14)	%
Positive aspects of the ARM for cardio exercise		
Rowing motion	11	78.57
Ability to get good cardio exercise	11	78.57
Working more muscle groups	6	42.86
Good challenge	6	42.86
Ability to engage trunk musculature	6	42.86
Ease of use of the ARM		
Minimal set up required	6	42.86
Anticipate being independent with set up	8	57.14
Challenges with using the ARM		
Anticipate needing help with set up	3	21.43
Handles difficult to use	5	35.71
Difficulty controlling trunk	3	21.43
Limitations of the ARM		
Machine lifting while pulling	4	28.57
Limited handle options	4	28.57

"Well obviously for health and fitness, but also participation, [the adaptive rower] lets me get out and do stuff. [It] removes some gaps and barriers and provides something that is not easily accessed right now. And provides something that is good for people, including even social stuff and community participation."
-Participant 1, 49 year old living with SCI

	n (14)	%
Positive aspects of the arm cycle		
Constant cyclical motion	8	57.14
Ability to get good cardio exercise	7	50.00
Ease of use of the arm cycle		
Adequate handles and grip	9	64.29
Good stability	8	57.14
Limitations of the arm cycle		
Finding it boring	3	21.43

Discussion / Conclusion

- Data from the interviews and the SUS questionnaires highlights that users' found both the ARM and arm cycle easy to use, but found the ARM to be better cardiovascular exercise.
- Effective cardiovascular exercise is important for wheelchair users' to decrease the risk of cardiovascular complications, which is now leading cause of death in those with SCI^[5].
- The ARM may help mitigate the existing barrier of lack of accessible cardio equipment for wheelchair users, by providing an effective and available exercise option in standard community gyms.
- The availability of the ARM may positively impact wheelchair users by providing greater opportunity for cardiovascular exercise, and promote inclusion and community participation, which are currently limited for many people with SCI^[6].

Acknowledgement

- International Collaboration On Repair Discoveries, (Seed Grant, Rick Hansen Foundation) - Physiology study
- Craig Neilsen Foundation - Ergometer development
- For more information on the ARM, please visit <https://adaptederg.commons.bcit.ca/>

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